

# Chapter 3

## Paving Equipment

Before paving operations can be started, all of the paving equipment must be checked for conformance with the specifications. If the equipment functions properly, the chances of a successful paving operation are greatly increased.

The major pieces of paving equipment that the bituminous paving inspector needs to know are distributors, pavers, widening machines, rollers, and hauling units (trucks). Check each piece of equipment prior to beginning the paving operation to ensure that equipment is in good working order and in compliance with specific requirements.

### Distributors

A distributor is used to apply liquid bituminous material such as prime and tack coats to surfaces to be paved. The distributor consists of an insulated tank mounted on a truck or trailer. A power-driven pump forces the asphalt through a system of spray bars and nozzles onto the construction surface. A burner, usually oil-fired, with flues within the tank is used to heat the asphalt to the proper application temperature. The major units for a typical distributor are shown on the opposite page.

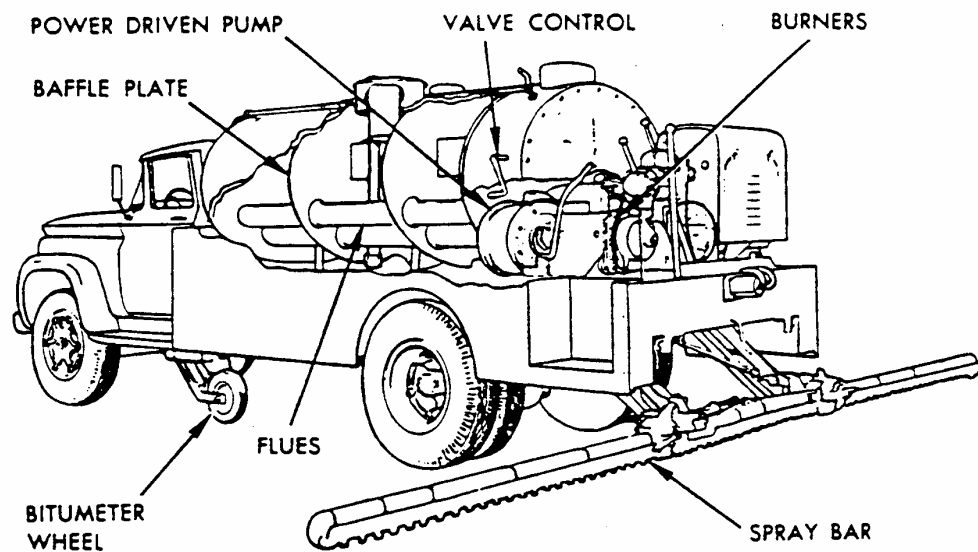
The distributor must be capable of:

- Maintaining the liquid asphalt at a uniform temperature;
- Applying material at a uniform rate from 0.05 to 2.0 gallons per square yard , with a variation from the specified rate of no more than  $\pm 0.02$  gallons per square yard; and
- Applying material at a uniform rate at variable widths up to 15 feet.

The distributor must be equipped with:

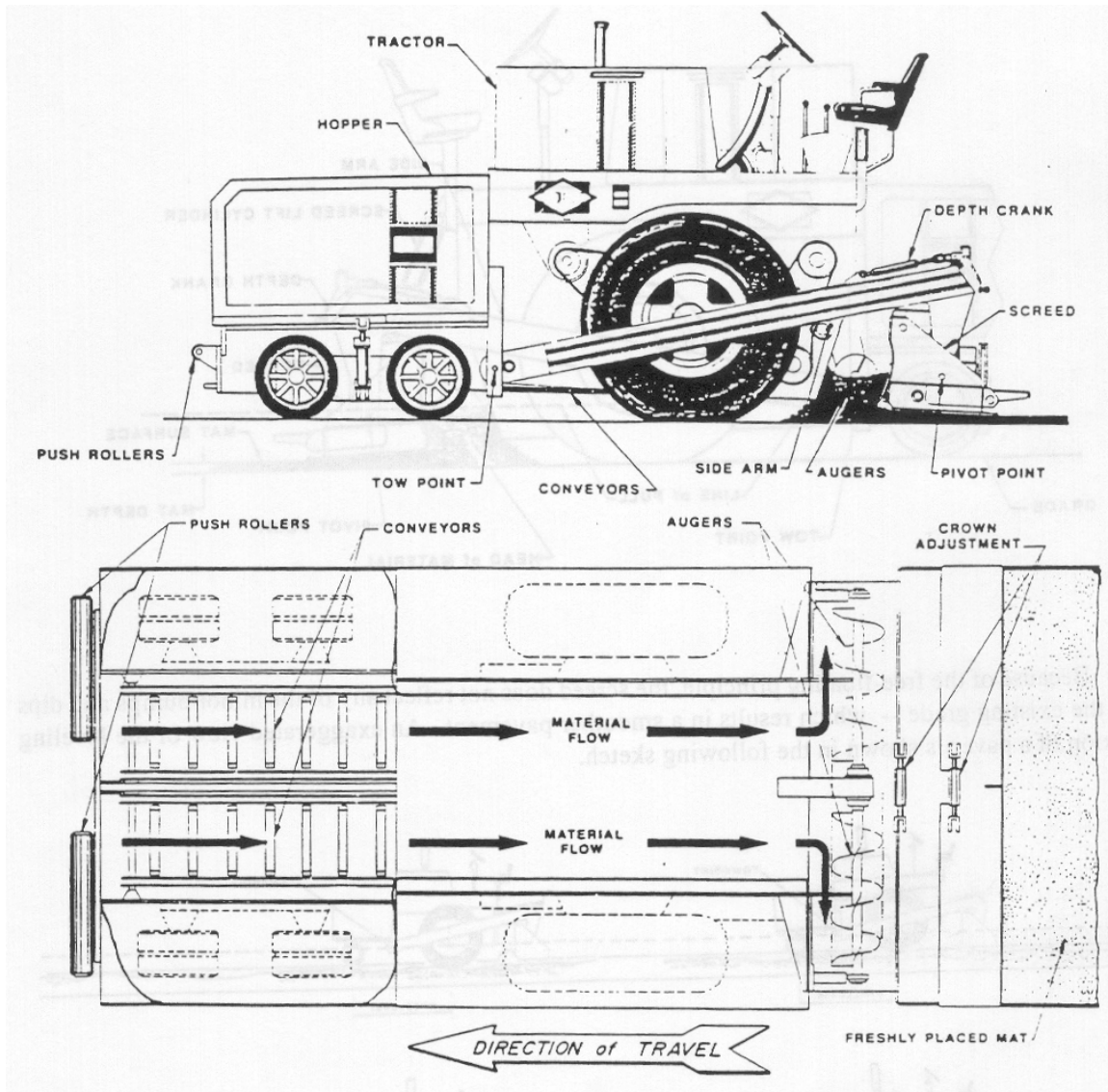
- A tachometer (Bitumeter) to measure the speed during applications;

- Pressure gauges;
- Accurate volume measuring gauges or a calibrated tank;
- A thermometer for measuring temperatures;
- A power unit for the pump; and
- Full circulating spray bars to prevent material cooling in the spray bars. The spray bars must adjust both laterally and vertically.



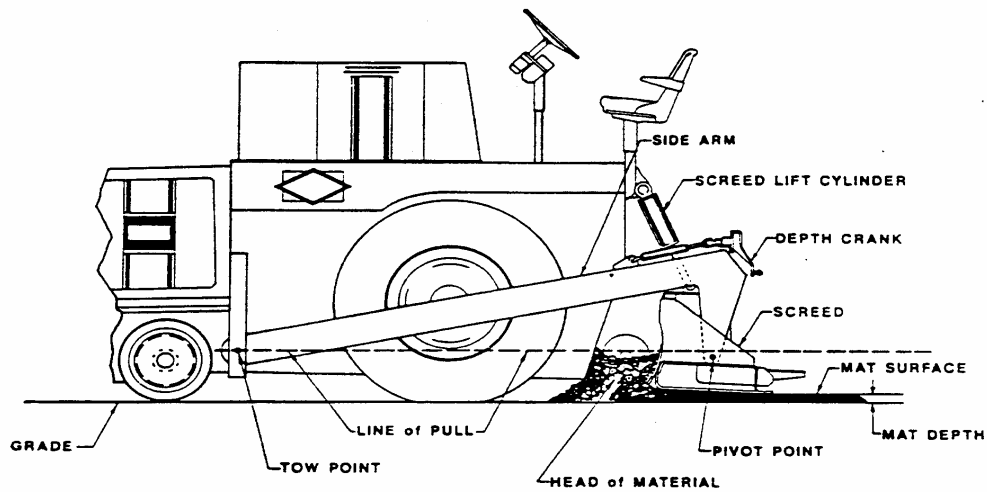
## Bituminous Pavers

Most asphalt plant mixtures are placed by a paver or finishing machine. The bituminous paver spreads the mixture, in either a uniform layer of a desired thickness or a variable layer to a desired elevation and cross section, ready for compaction.

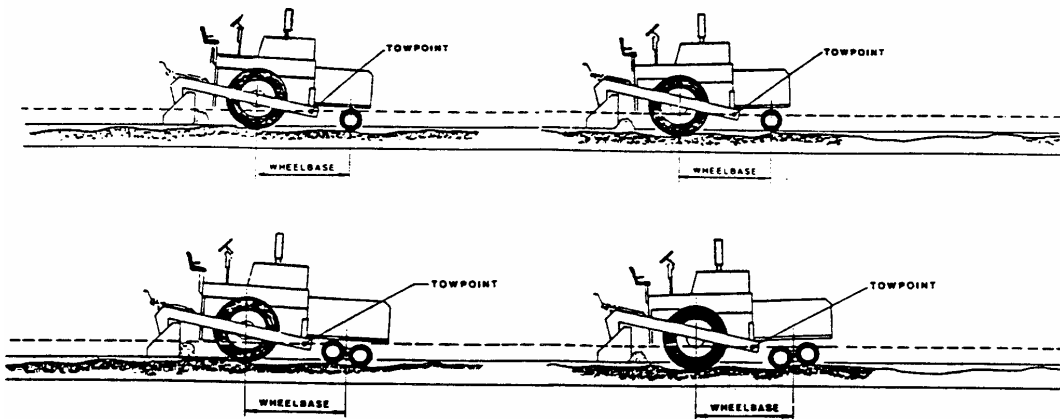


The paver consists essentially of two basic units: a tractor and a screed. The tractor receives, conveys and augers the mixture to the screed and propels the screed forward. The tractor may be mounted on either rubber tires or crawlers. In addition to the engine, the tractor unit has a hopper for receiving mix from the haul trucks, conveyors to move the mix through the flow control gates to the augers, flow gates to prevent overloading the augers, and augers to evenly spread the mix in front of the screed. Rollers are mounted on the front of the tractor to push the haul trucks during the dumping process. The rollers should turn freely so the trucks will have little effect on paver operation.

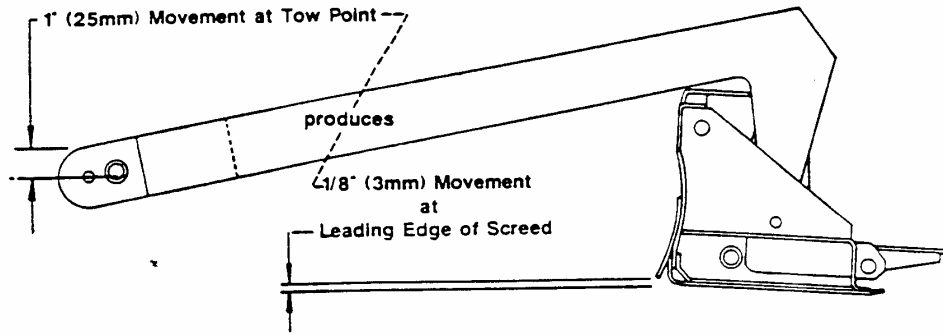
The screed performs the actual placing of bituminous material to the desired width and thickness or elevation as shown in the sketch below. The screed is towed by the tractor and is free to float up or down until the bottom of the screed is parallel with the grade over which it is traveling.



Because of the free-floating principle, the screed does not reflect any of the minor bumps and dips in the existing grade -- which results in a smoother pavement. An exaggerated view of the leveling action of a paver is shown in the following sketch.



The relationship between the vertical movement of the screed tow point and the elevation of the screed is illustrated below. There is an 8 to 1 ratio so that a 1 inch vertical movement of the tow point will result in only a 1/8 inch vertical corrective movement of the screed. And before that 1/8 inch movement is accomplished, the paver must move 5 times the length of the screed side arm. This relationship is the key to the paver's ability to lay smooth pavements.

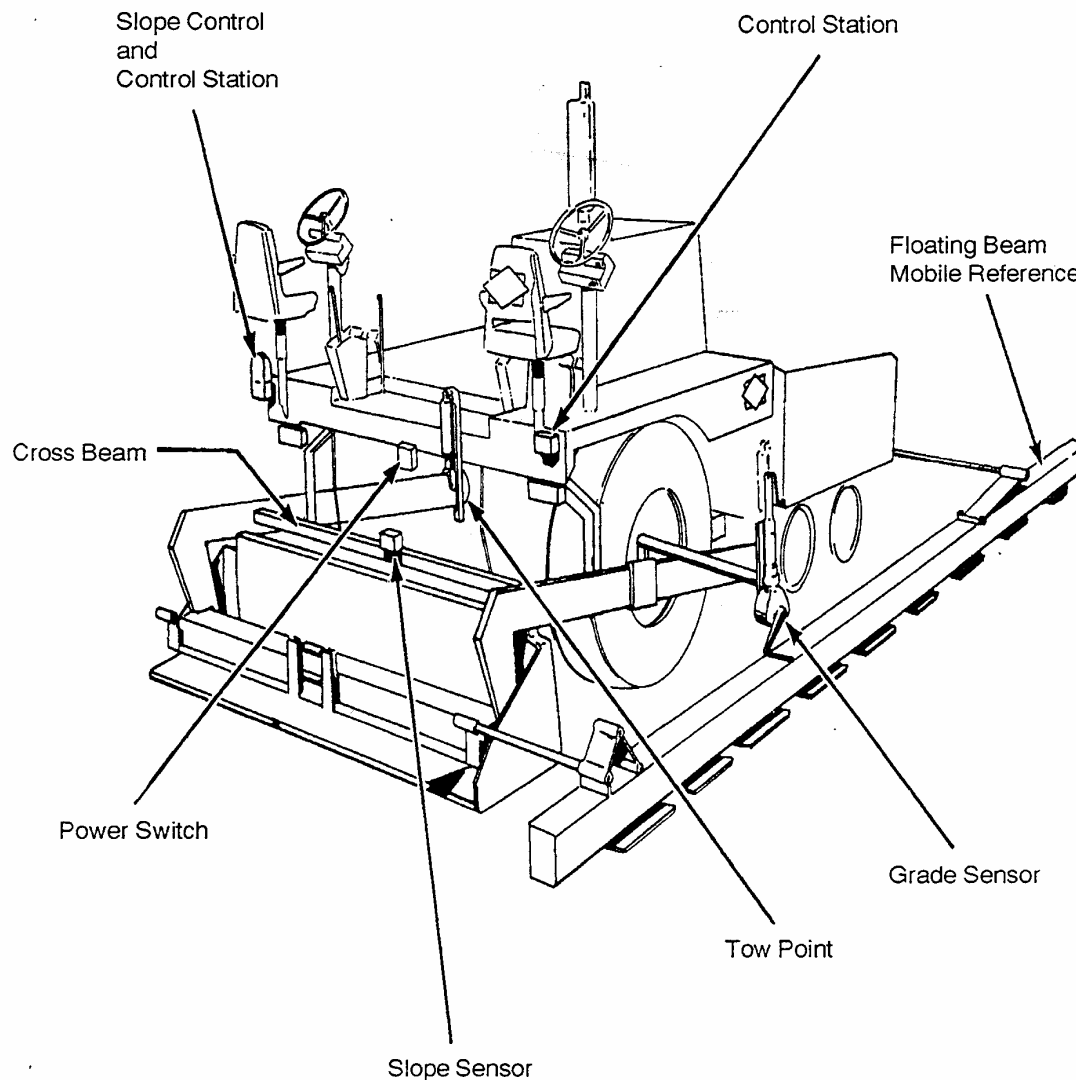


Specifications (see Section 408 of the Standard Specifications) require that a paver:

- Be a self-contained power propelled unit.
- Be equipped with an activated (vibratory) screed or strike-off assembly capable of being heated for its full length, including extensions.
- Be capable of spreading and finishing mix in lane widths shown on the typical sections for the project.
- Be equipped with automatic grade and slope controls if the width of the roadway or shoulder to be paved is 8 feet or wider. The operator's control panel must have gauges that show compliance with the established grade and slope.
- Have a grade leveler (commonly called a ski) for attachment to the paver to activate the automatic grade control.

The automatic screed controls can be set for manual, semiautomatic or automatic operation on most major brand pavers. Automatic screed controls typically have these main components, as illustrated for one make of paver in the next sketch.

- Grade sensor,
- Slope sensor,
- Control station
- Slope control, plus
- Motors and hydraulic cylinders to change the screed tilt.



The grade sensor rides on a stringline, a ski or a joint matcher to detect changes in elevation and transmits the information electronically to the controls. The electronic controls can be checked by varying the position of the grade sensor and observing if the screed controls react to make the correct adjustment. When the ski is used, the grade sensor should always ride on the center of the ski so that all elevation changes are averaged.

Use of the automatic controls further enhances the paver's capability to produce a smooth pavement surface regardless of irregularities in the surface being paved. Slope -- crown or superelevation-- is controlled by the slope sensor or pendulum set for the desired slope. Once the screed is set for the desired mat thickness and slope, the

automatic controls activate the motors or cylinders to change the screed tilt to automatically compensate for road surface irregularities.

## Widening Machines

Widening machines are used when the width to be laid is too narrow or inaccessible for the regular paver. One example is the inside 4-foot wide shoulder of a dual-lane highway, when it cannot be laid with the traveled way.



These pavers must be self-propelled and capable of placing material at variable widths. Vibrating or heated screeds and automatic grade and slope controls are not required for these machines. Automatic grade controls for matching joints are available on some models, however.

Self-propelled wideners such as the one shown are usually used for

widths up to 4 feet and wideners mounted on motor-graders for widths between 4 feet and 8 feet. The use of widening pavers is not permitted on widths of 8 feet or more.

## Rollers

Five types of rollers are used for compacting bituminous pavements: two-axle tandem, three-wheeled, three-axle tandem, pneumatic tire, vibratory and trench. All but the pneumatic tired roller have steel wheels.

All rollers must have proper sprinkling systems to wet the drums or tires to prevent the mix from sticking. Scrapers are usually required on steel-wheel rollers. Rollers must be equipped with drip pans to prevent oil, grease, or fuel from dropping onto the roadway -- any petroleum product will damage bituminous pavement. Clutches must function smoothly; a roller that jerks when starting, stopping or reversing will contribute to a rough surface.



## Two-Axle Tandem Roller

A two-axle tandem steel-wheel roller must weigh at least ten tons.



## Three-Wheel Roller



The three-wheel roller must weigh ten tons or more. The compression or drive rolls must produce a bearing of at least 300 pounds per linear inch of roll width. The bearing is computed by dividing the weight of the drive axle by the combined width of the two rolls. A tandem roller, which has a drive wheel bearing of no less than 300 lb/in may be used in lieu of the three wheel roller.

## Three-Axle Tandem Roller

The three-axle tandem steel-wheel roller must weigh at least 15 tons (13.5 Mg).





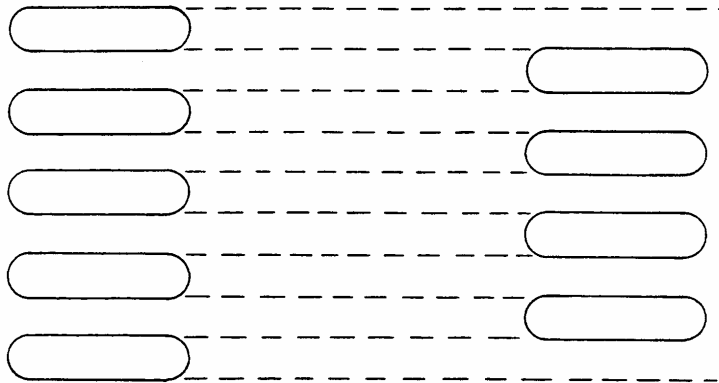
## Pneumatic-Tired Roller

Pneumatic-tired rollers must:

- Be self-propelled;
- Have a minimum width of 5 feet 6 inches
- Be equipped with wide-tread compaction tires, with a minimum size 7:50 by 15;
- Be capable of exerting a uniform, average contact pressure from 50 to 90 pounds per square inch over the surface by adjusting ballast and tire pressure; and
- Have wheels on at least one axle that are fully oscillating vertically and so mounted so as to prevent scuffing of the surface during rolling or turning.



The tires on a pneumatic-tired roller are typically arranged so the gaps between the tires on one axle are covered by the tires of the other as shown below.



The contractor is required to furnish charts and tabulations showing the contact areas and pressures for the full range of tire inflation pressures and for the full range of tire loadings for each type and size of roller to be used.

## Vibratory Roller

A vibratory roller is a steel-wheeled roller that has the capability of oscillating one or both of the steel rollers.

Only vibratory rollers specifically designed for the compaction of asphaltic concrete mixtures may be used. Vibratory rollers must be equipped with a variable amplitude system, a speed control device and have a minimum vibration frequency of 2,000 vibrations per minute. A reed tachometer shall be provided for use by the contractor for use in verifying the operation frequency. The Department maintains a list of approved vibratory rollers. The latest list at the time of printing this manual is included in one of the Appendixes (See your PE/PS for the list that is for your current contract).



## Trench Rollers

When the width of a trench is too narrow to accommodate a standard roller, a trench roller is used for compaction. The roller must be of sufficient weight to exert a pressure of 300 pounds per linear inch of width for the compression roll. The compression roll may be either hollow or solid. Weight is added to hollow rolls by filling them with water ballast. Counter-weights are used for rollers with solid rolls.

To provide uniform compaction for the entire width of the compression roll, the face of the roll must be parallel to the surface being compacted. Trench rollers use a vertical adjustment on the wheel not in the trench to tilt the machine to accomplish this.





## Material Transfer Vehicles



Material Transfer Vehicles or Shuttle Buggies are used to transfer mix from the haul trucks to the paver. The use of a MTV can greatly reduce the chances of segregation in the pavement.

## Haul Trucks



The condition of the haul trucks need to be continuously monitored. Here are some checks the paving inspector should make.

- Watch for truck beds that are leaking mix because the gates are not tight;
- Watch for foreign material in the mix which would indicate that the beds were not clean when loaded;
- Be sure the trucks are equipped with tarps and that the tarps are in place when needed to keep the material from cooling or becoming contaminated en route;
- Make sure the tarps overlap the bed of the trucks by enough to prevent rain and foreign material from getting in the mix.
- Have the tarps rolled back to inspect the appearance of the mix before allowing the load to be dumped;
- Watch for evidence of the excess use of anti-adhesive agent;
- Check each truck for an easy to read identification number; and
- Make sure there are no hydraulic or fuel leaks. Either will permanently damage the bituminous pavement.

## **Hand Tools**

Normal hand tools used in the paving operation are shovels, lutes and ten-foot straightedges.